THE AMERICAN GAS-LIGHT JOURNAL AND CHEMICAL REPERTORY

Publishing Office, No. 42 Pine Street.

Devoted to the Interests of Illumination, Heating, Ventilation and Sanitary Improvement, Domestic Economy, and General Science.

VOLUME XV.—No. 6. WHOLE No. 251. | NEW YORK, SATURDAY, SEPTEMBER 16, 1871. | $3 PER ANNUM IN ADVANCE.

Portable Gas Generator.

The proprietors claim for the gas generator illustrated in the accompanying engravings, which they style the "Columbia Portable Gas Generator," that it is superior in cheapness, safety, economy, and durability, to any apparatus heretofore offered to the public. The machine is now on exhibition at 708 Broadway, and will we understand, be exhibited at the present Fair of the American Institute, commenced in the early part of September.

The machine has certainly the merit of simplicity, and we are told works well even in cold weather, without the aid of heat, consuming gasoline of the density of 85°, without condensation. In warm weather much heavier fluid may be used

The machine consists essentially of two parts, an air compresser or forcing apparatus, and an apparatus for charging the air with the hydrocarbon vapor.

A barrel or case, A. Fig. 1, is divided by a diaphragm, B, Fig. 2, into two compartments or chambers, which communicate with each other by means of the pipe, C. The fluid is put into the case through a supply cock, not shown, and rises to a common level in both compartments. In operation this fluid circulates more or less through the pipe, C, between the compartment containing the carburizing apparatus to the chamber containing the air-forcing apparatus. The denser portions of the fluid are, by revolving drums, D, E, Fig. 2, kept constantly stirred up, mingled and vaporized with the lighter portions.

The drum, lettered E, is the air-forcing drum. It consists of a set of buckets extending spirally as shown in Fig. 3, from the hollow shaft, F, Fig. 2. It rotates in the reverse direction from that of an overshot water wheel, and in so doing carries the air which enters the chamber through the pipe, G, under the surface of the fluid. Thence the air passes through the perforations in the hollow shaft and through the shaft into the carburizing chamber, passing out of perforations in the

Fig. 1

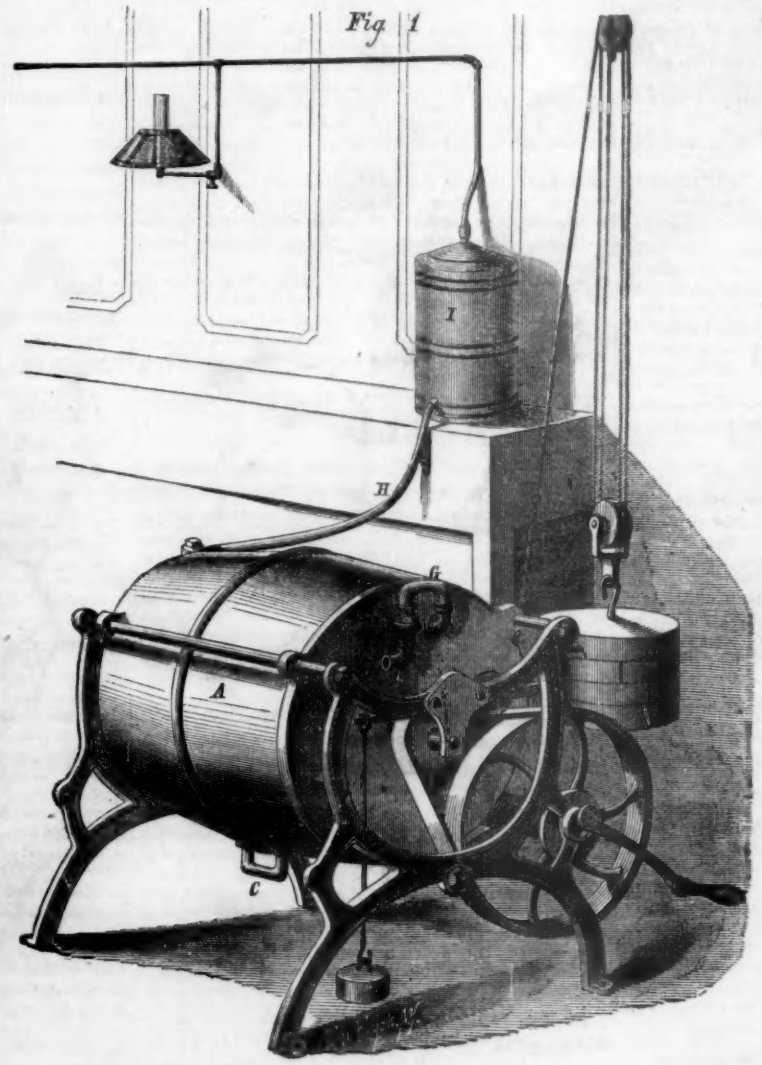
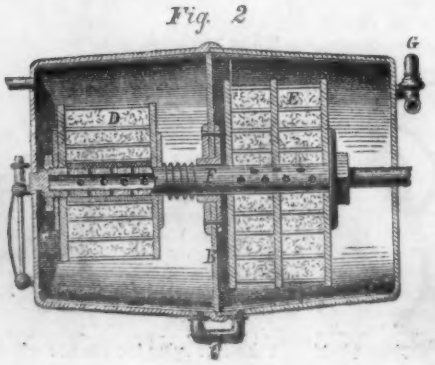


Fig. 3

Fig. 2



shaft into the buckets of the carburizing drum.

This drum is similar in construction to the other, but it is smaller and has a less number of buckets. In the hollows of these buckets is placed felt, wool, or other capillary and absorbent material, which is kept constantly saturated in passing through the hydrocarbon liquid, and the air in passing out through this material becomes charged with illuminating vapor, or gas. In this state it is passed through the pipe H, into the chamber, I whence it is passed to the service. The chamber-I, acts as a storage for the gas, so that enough will be kept therein to supply the burners when winding up the machine.

The carburizing drum has its buckets placed in a reverse position on the shaft to those of the forcing drum or compresser.

The power used to drive the machine is a weight and cord, acting through a shaft, pulleys, and belt. The weight is wound up in the usual manner.

Patented January 1, 1870. For further information address J. C. Dial, President Columbia Portable Gas Light Company, Columbia, S. C., or E. C. Plumer, 708 Broadway New York city.

THE STREETS of New York are lighted by 18,017 gas burners, owned by the different companies as follows:—Manhattan, 7084; New York, 3241; Harlem, 4000; Metropolitan 3692. Each burner consumes 3 ft. of gas per hour, and burns 3833 hours and twenty minutes per year. The price paid the companies is 54 dollars per annum for each lamp. Each lamp post cost the city 20 dollars, and each lamp 4.50 dollars to construct. The number of feet of gas burned per annum by the city in lighting the streets is 134,360,483; the cost of material is 441,416.50 dollars; the annual cost of gas is 954,001 dollars. The Manhattan Company has two hundred miles of main pipe; the N. Y. Co., one hundred; the Metropolitan, ninety-five, and the Harlem Company, ninety-eight.

Chemical Repertory,
No. 58.—September 16, 1871.
EDITOR—HENRY WURTZ.

CHEMICAL EXCERPTS.

57. Drying-Oil Substitute.—A composition for mixing with white-lead and other colors, to form a paint in lieu of linseed oil, turpentine, and the usual driers, has been lately brought out. The advantages claimed for this vehicle are, it dries very quickly. In less than half an hour after application it is sufficiently dry and hard to receive another coat. It is perfectly inodorous. A room can be used the same day it is painted. It is peculiarly adapted for painting offices, counting-houses, stairs, ships' cabins, and all work where time is an object. It cleans readily, and is not affected by soap or alkalies. It is economical in use, though the composition is in itself necessarily from the materials employed, dearer than linseed oil. In consequence of the body contained in the composition, three coats of paint mixed with it are equal to four of ordinary paint; and the great saving in the time always lost by workmen in going from one job to another, or waiting until such paint is dry, is more than sufficient compensation for the greater original cost. For example, a street-door, which requires the attendance of a workman on five several days to complete the painting and varnishing, can, by the use of this composition, be painted with four coats and varnished in one day. The material consists of methlylated spirit, shellac, and castor-oil.—*London Artizan.*

58. Adulteration of Coffee.—By J. M. Merrick, S. B.

Having recently had occasion to examine some samples of ground coffee for adulterations, I attempted to apply the test recommeded by Vogel.

Two or three grammes of the suspected coffee is stirred up with 20 cc. of cold water, filtered after standing five minutes, and the filtrate boiled with a few drops of a solution of sulphate of copper made by mixing equal volumes of a saturated solution and distilled water.

The boiled liquid is filtered and again boiled with an excess of caustic potash solution, when, according to Vogel, "if the coffee is adulterated the fluid takes on a brown color, and on cooling deposits a precipitate of suboxide of copper whose amount appears proportional to the quantity of adulteration, etc.

In the coffee which I examined by this method, the kernels during roasting had had a quantity of some kind of sugar, molasses in all probability, stirred into the mass, and of course I obtained a copious precipitate of suboxide of copper, although the coffee, with the exception of this addition, was perfectly pure. The possibility of such a falsification, if that is a fair term, seems to have been overlooked by Vogel.—*Am. Chemist.*

59. Dubious Logic.—In some remarks on the new New Orleans *Ammonia Engine* (which has some ingenious features) an esteemed contemporary commits a singular *faux pas*, as thus:

Very little things sometimes lead to distrust; and that the committee state the composition of ammonia as "three volumes of hydrogen to one of nitrogen condensed into two volumes," may cause some to doubt their perfect familiarity with the subject on which they report. Parties who omit mention of oxygen in setting forth the elements comprised in ammonia might possibly neglect in their statement some of the essentials in the *modus operandi* of a machine.

[Why omitting oxygen among the elements of ammonia, which contains none, should have cast such a stigma upon the parties concerned, we know not.]

60. Distillation and Boiling Point of Glycerine: by Thomas Bolas.—The boiling-point of glycerine was determined by effecting the distillation in a long-necked flask, having a supplementary neck attached at right angles to the principal one. In the principal neck, the thermometer was fixed by the aid of a caoutchouc cork, while the smaller neck was connected in a similar manner with a two-necked receiver. The glycerine, together with a few fragments of tobacco-pipe (this latter being required to prevent the bumping which would otherwise occur), being placed in the retort flask, the receiver was connected with a Sprengel's mercurial pump and a manometer, the caoutchouc joints being made air-tight with glycerine in the usual way. Unless the glycerine distilled had been dehydrated by previous distillation in a vacuum, the first portion of the distillate consisted principally of water; afterwards, when the glycerine in a pure state came over, the temperature indicated by the thermometer was 179.5° C. At this time, the pressure on the liquid was 12.5 m.m., a presure nearly corresponding to the tension of aqueous vapor at the temperature of the receiver.

Under a pressure of 50 m.m., glycerine distills without change at about 210° C. Glycerine, dehydrated by distillation, absorbs water from the atmosphere to the extent of about fifty per cent. of its weight. The amount absorbed is, as might be expected, very variable.—*Lond. Artizan.*

61. Roasting of Coffee.—Rabuteau has stated to the French Academy that this should be so accomplished, that it shall contain all the caffeine, the true active principle of the berry, and should not contain caffeone, an essential oil developed in roasting. This latter principle the author asserts is the one which excites, and causes the injurious effects so often found to arise from the use of coffee. Its formation may be to a considerable extent prevented by roasting the coffee in a current of heated air.—*Am. Chemist.*

62. Purity of Linen.—Zimmermann proposes to discover cotton in linen tissues by dipping the sample for eight or ten minutes into a mixture of two parts of nitric and three parts of sulphuric acids. If cotton be present, gun-cotton, which can be extracted by a mixture of alcohol and ether, would be formed in this manner. Better than this, and really excellent for tissues that are not dyed, is Frankenstein's oil test. A sample of the goods is dipped into olive or colza oil, which is eagerly absorbed by the fabric. The sample is then pressed between pieces of unsized paper in order to remove the excess of oil. If the tissue consists of mixed fibres, it will now appear striped, the linen threads having become transparent, and appearing lighter than the cotton threads, which remain unchanged. If the prepared sample, on the other hand, be placed upon a dark surface, the linen threads appear darker than those of the cotton. In this, as in all other tests mentioned heretofore, it is advisable to pull out a few threads from the edge of the sample before proceeding with the experiment. Decidedly the best and safest method, and one applicable in all cases, is a microscopic examination, by which not only the structure, but also the nature of the fibre can be demonstrated.—*Technologizt.*

62. Sudden and Spontaneous Opacity of Gas Contained in a Balloon.—Observations having been frequently made by aeronauts, that when the gas is allowed to escape from balloons when in an elevated position, the gas appears like a whitish smoke, whence they have coined the expression of "the balloon smoking its pipe"; M. de Fonvielle explains this as the result of cold which arises from the increase in volume of the balloon in a rarified atmosphere. The vapor of water in the gas is thus condensed, and assumes the whitish smoke-like appearance.—*American Chemist.*

64. New Method for Tinning Cast Iron.—It is founded on the method for making malleable cast-iron. The surface of the cast-iron objects is decarbonized by keeping it for several days in closed vessels with powdered hematite, under the influence of a red heat, till a sample taken out, after being properly cleaned, will take the tinning as easily as wrought-iron. Then the object is slowly cooled, taken out, placed in an acid bath, and plunged in the melted tin alloy, the surface of which is covered with fat or tallow, to prevent oxidation. Experience has proved charcoal-iron is the best for this purpose.—*Manufacturer and Builder.*

65. The Late Renowned "Sherman Process."—With regard to this, R. F. Mushet wrote to the *Mining Journal* in the following highly interesting style:

"The wholesale extraction of sulphur and phosphorus from pig-iron was reserved for Mr. Sherman, and the laws of chemical equivalents at once gave way, to permit the free use of Glengarnock pig-iron in the Bessemer converter, not *cum grano salis*, but with a pinch of iodine. Messrs. John Brown and Co. seem to have befriended Mr. Sherman at a pinch, and have not gainsayed the marvellous statements put forth of results obtained at the Atlas Works. The "Jones Steel Pig," whose squeak some years ago resounded through the Cleveland district, must now cede the palm of victory to the "Sherman Steel Pig." As every dog is said to have its day, so probably each steel pig, whether of Jones or of Sherman, must occupy its nook (I had almost said "stye") in the temple of fame; and when Mr. Sherman, with his steel pig, and the star spangled banner which over it waves, returns to the land of the free and the home of the braves, may the squeak of this pig put to silence all knaves."

66 Delights of Ballooning.—The greatest height ever attained by an aeronaut was reached by Mr. Glaisher in the summer of 1862. He became insensible when at an altitude of about six miles, and his companion, Mr. Coxwell, lost the use of his hands, but pulled the valve string with his teeth, and thus caused gas to escape and the balloon to descend. An observation made by Mr. Coxwell during Mr. Glaisher's insensibility appeared to indicate that the greatest altitude attained was 6½ miles, and that the temperature was then 12° below zero of Fahrenheit.

67. New Pneumatic Letter Delivery.—The following astounding information we owe to that excellent Journal, the *London Artizan:*

The post office pillar boxes in New York are connected by a pneumatic tube that runs round the city to the general receiving house. As the letters are dropped into the box they are blown along the tube at a rate of sixty-five miles an hour.

Extracts from the Gas Referees Report on Burners.

[Since last issue, in which we referred to a copy of the Report on Burners, received through Prof. Silliman, we have been personally favored with a copy, which, together with a copy of their Report on Ammonia in Gas, received at the same time, we here thankfully acknowledge, and have endeavored to condense both these documents into a compass appropriate for our columns.—Ed.]

To Prof. Wurtz, *with the compliments of the Gas Referees:*

Return to an Order of the House of Lords, dated 31st July, 1871, for Copy of First Report to the Board of Trade by the Gas Referees, on the Construction of Gas Burners, with reference to the Principles of Gas Illumination.

To the Lords of the Committee of Privy Council for Trade.

Gas Referees' Department,
23 New St., Spring Gardens, June 22, 1871.)

Every improvement in the construction of gas burners is equivalent, in its economical effects, to the discovery of a method of cheapening the manufacture and supply of gas; for it enables the public to obtain more light from the gas which they consume and pay for. By using good burners, instead of bad ones, consumers may obtain from 30 to 50 per cent. more light, while their gas bills remain the same.

Inspection fully confirmed the apprehensions which the referees had formed from their examination of the burners procured from the gas-fitting establishments. For example, in the offices of two of the daily newspapers (establishments which consume more gas than any others), it was found that the burners chiefly in use were so defective that they gave out only *one half* of the illuminating power of the gas actually consumed. And several of the burners tested by the referees gave only *one-fourth* of the proper light of the gas!

The gas rental of London amounts annually to more than *two millions sterling*. Upwards of *one-fourth* of this sum (£500,000 per annum) might be saved by the use of good burners. How much vaster the sum thus economised if good gas burners were to come into general use throughout England! In truth, the economy arising to the public from the use of improved burners is as large as can be produced for many years to come from any improvements in the manufacture of gas.

On the Illuminating Power of Gas.

The doctrine that the illuminating power of gas *does* vary (although in what ratio is not agreed) according to the quantity of gas consumed, appears to have taken firm ground, on the Continent, as well as in this country, and in America.

In a case like this, the first and most natural suggestion is, to inquire whether the observed variations in the illuminating power are not due, wholly or in part, to the mechanical apparatus employed for developing it. If four feet of gas does not give exactly two-thirds the amount of light which six feet of the same gas gives, is not the difference first to be looked for in the nature of the burners employed in the experiments?

As every scientifically constructed boiler is devised specially for a given amount of coal, by the consumption of which the boiler develops its maximum of

power relative to the quantity of fuel used; so every well constructed burner is devised to consume a fixed quantity of gas. Indeed, for every burner, whether good or bad, there is a certain rate of consumption at which the burner does more justice to the illuminating power of the gas than at other rates, whether greater or less.

The proper regulation of the supply of air to the flame is the chief secret of developing a maximum of light from gas. The greater the quantity, or the richer the quality, of the gas, the more air is required, and hence the better will the flame bear contact with the atmosphere; for, the greater is the quantity of matter to be oxidised, or consumed by combustion. And it is important to observe that the greater the velocity with which gas issues from a burner, the greater is the supply of air to the flame—the more air is the flame brought in contact with. The stream of burning gas from the burner, rising through the (we shall say) quiescent atmosphere of the room, draws in the air upon itself, just as a rapid stream passing through a pool or lake disturbs the stillness of the pool, and draws in upon itself in eddies the surrounding water; and the more rapid the upward stream of gas, the greater the quantity of air thus drawn in upon the flame.

The experiments here given were made at intervals during the last two years. The gas with which the experiments were made was common gas having an average illuminating power of 15 sperm candles, when consumed at the rate of five feet per hour in Sugg's London Argand No. 1. This Argand, burning at the above-mentioned rate, was taken as the standard in the experiments, and its light reckoned as 100.

[An extended tabular statement is then given of experiments made with six fishtail and two batwing burners, at varying pressures. We can cite but their general conclusions.]

If the doctrine maintained by various experimentalists in this country, and which Mr. Farmer carried to an extreme, were correct, we should find the burners giving more and more light, relative to the quantity of gas consumed, as the rate of consumption is increased; but these experiments show to demonstration that such is not the case. Instead of the gas giving more light as the rate of consumption is increased, it will be seen that, *in every case, there is a point beyond which the light* DECREASES relatively to the proportion of gas consumed. In every case, too, this point lies below, and in most cases is *far below*, the maximum of ordinary gas consumption. Observe the turning-points in the case of the different burners. In one the maximum of light given out is when the gas is burning at the rate of five feet an hour, beyond which point the more gas burned the less is the proportion of light which it gives. In another the maximum of light is at 4.6 feet an hour; in another it is at 4·2 feet; in two others it is about 3 feet; in one it is at 2 feet; and in two at only 1¾ foot!

But when we come to deal with Argrnd burners, we encounter results which tend to explain how the doctrine arose. As already said, the chief means of obtaining the maximum of illuminating power from gas is, to ensure an exactly adequate supply of air to the gas flame; and, with Argands, this point is easily found, for it immediately precedes the stage of combustion at which the flame smokes. With the batwing and fishtail burners used in the preceding experiments, there was no rate of consumption at which the flame of any of them visibly smoked; and this holds good in regard to almost all batwing and fishtail burners when used with common gas, that is, gas of from 12 to 16 candle power. But with argands (owing to the glass chimney which encloses them, and regulates the air supply), it is always possible to increase the consumption of gas to such a point as will make the flame smoke; and hence every burner of this kind can be used in a manner which will give the full illuminating power of the gas, *so far as that is dependent upon an adequate air supply*. Now, as the common fault of argands is, that the gas issues under too great a pressure, that is, with too great a velocity, thereby bringing the flame in contact with too much air, it follows that the worse the argand, the better will it become when a large quantity of gas is burnt in it; for the air supply, as regulated by the chimney, being nearly a fixed quantity, any excess in the air supply can be neutralised by increasing the quantity of gas consumed. But with all argands, whether good or bad, the larger the quantity of gas consumed in them (short of smoking), the greater will be the proportion of light which they give from the gas. These facts, we repeat, tend to explain the origin of the erroneous and practically misleading doctrine, that the capacity of gas to give light increases with the quantity of gas consumed.

[They then tabulate experiments with four argand burners, first, Sugg's London, which at five feet consumption, they call 100, two others, which they deem good ordinary argands, at five feet gave 65 to 70, while a fourth very *bad* burner gave but about 30.]

Here it is shown that the larger the quantity of gas consumed in argands, short of smoking, the higher the proportion of light which they give from the gas. But it is to be noticed, that even at this most favorable point of consumption there is a vast difference in the amount of light given by the different burners (a most important fact, the causes of which will be fully considered in the sequel). In short, then, these experiments with argands, like the previous ones with batwings and fishtails, show the paramount influence which the burner has upon the amount of light obtained from the gas. While No. 1 gives (what we may for the present call) the full illuminating power of the gas, which is taken as 100, Nos. 2 and 3 give a light only equal to 78, and No. 4 a light only equal to 84.

[To be continued.]

[Communicated by the Author.]

Report of the Rock Oil, or Petroleum, From Venango Co., Pennsylvania.

With special reference to its use for illumination and other purposes.

By B. Silliman, Jr.

Professor of General and Applied Chemistry, Yale College.

[*Special Editorial Note.—Erratum.*—In our solicitude that our readers should know beforehand the *date* of this original Petroleum investigation, April 16, 1855, we introduced it into the heading. The types, however, played on us one of their wonted tricks, and laughed us to scorn, by converting 1855 into 1871, We urge those who file the Journal to make the correction.—Ed.]

REPORT.

[Concluded from page 68.]

PROPERTIES OF THE DISTILLED OILS.

Exposed to the severest cold of the past winter, all the oils obtained in this distillation remained fluid. Only the last two or three appeared at all stiffened by a cold of 15° below zero, while the first three or four products of distillation retained a perfect degree of fluidity. Exposed to air, as I have said, they suffer no change. The chemical examination of these oils showed that they were all composed of Carbon and Hydrogen, and probably have these elements in the same numerical relation. When first distilled, they all had an acid reaction, due to the presence of a small quantity of free sulphuric acid, derived from the crude oil. This was entirely removed by a weak alkaline water, and even by boiling on pure water. Clean copper remained untarnished in the oil which had been thus prepared, showing its fitness for lubrication, so far as absence of corrosive quality is concerned. The oils contain no oxygen, as is clearly shown by the fact that clean potassium remains bright in them. Strong *Sulphuric Acid* decomposes and destroys the oil entirely. *Nitric Acid* changes it to a yellow, oily fluid, similar to the changes produced by Nitric acid on other oils. *Hydrochloric, Chromic* and *Acetic Acids*, do not affect it. *Litharge* and other metallic oxyds do not change it, or convert it in any degree to a drying oil. *Potassium* remains in it unaffected, even at a high temperature. *Hydrates of Potash, Soda*, and *Lime*, are also without action on it. *Chloride of Calcium* and many other salts manifest an equal indifference to it. Distilled with *Bleaching Powder* (chlorid of lime) and water, in the manner of producing chloroform, the oil is changed into a product having an odor and taste resembling chloroform. Exposed for many days in an open vessel, at a regulated heat below 212°, the oil gradually rises in vapor, as may be seen from its staining the paper used to cover the vessel from dust, and also by its sensible diminution. Six or eight fluid ounces, exposed in this manner in a metallic vessel for six weeks or more, the heat never exceeding 200°, gradually and slowly diminished, grew yellow, and finally left a small residue of dark-brown lustrous looking resin, or pitchy substance, which in the cold was hard and brittle. The samples of oil employed were very nearly colorless. This is remarkable when we remember that the temperature of the distillation was above 500° Fah. The oil is nearly insoluble in pure alcohol, not more than 4 or 5 per centum being dissolved by this agent. In ether the oil dissolves completely, and on gentle heating is left unchanged by the evaporization of the ether. India Rubber is dissolved by the distilled oil to a pasty mass, forming a thick black fluid which, after a short time deposits the india rubber. It dissolved a little amber, but only sufficient to color the oil red. It also dissolves a small portion of copal in its natural state; but after roasting, the copal dissolves in it as it does in other oils.

USE FOR GAS MAKING.

The Crude Oil was tried as a means of illlumination. For this purpose a weighed quantity was decomposed, by passing it through a wrought iron retort filled with carbon, and ignited to full redness. The products of this decomposition were received in a suitable apparatus. It produced nearly pure Carburetted Hydrogen Gas, the most highly illuminating of all the carbon gases. In fact, the oil may be regarded as chemically identical with illuminating gas in a liquid form. The gas produced, equalled ten cubic feet to the pound of oil. It burned with an intense flame, smoking in the ordinary gas jet, but furnishing the most perfect flame with the argand burner.

These experiments were not prosecuted further, because it was assumed that other products, now known and in use, for gas making, might be employed at less expense for this purpose, than your oil. Nevertheless, this branch of inquiry may be worthy of further attention.

DISTILLATION AT A HIGHER TEMPERATURE.

The results of the distillation at a regulated temperature in glass, led us to believe, that in a metallic vessel, capable of enduring a high degree of heat, we might obtain a much larger proportion of valuable products. A copper still, holding five or six gallons was therefore provided, and furnished with an opening, through which a thermometer could be introduced into the interior of the vessel. Fourteen imperial quarts (or, by weight, 560 ounces) of the crude product were placed in this vessel, and the heat raised rapidly to about 280° C., (=536° Fah.,) somewhat higher than the last temperature reached in the first distillation. At this high temperature the distillation was somewhat rapid, and the product was easily condensed without a worm. The product of the first stage was 130 ozs., (or over 28 per cent.,) of a very light colored thin oil, having a density of .792. This product was also acid, and as before, the acid was easily removed by boiling with fresh water. The temperature was now raised to somewhat above 300° C., (=572° Fah.,) and 123 ozs. more distilled, of a more viscid and yellowish oil, having a density of .865. This accounts for over 43 per cent. of the whole quantity taken. The temperature being raised now above the boiling point of mercury, was continued at that until 170 ounces, or over 31 per cent., of a dark brown oil had been distilled, having a strong empyreumatic odor. Upon standing still for some time, a dark blackish sediment was seen to settle from this portion, and on boiling it with water, the unpleasant odor was in a great degree removed, and the fluid became more light colored and perfectly bright. (It was on a sample of this that the photometric experiments were made.) The next portion, distilled at about 700° Fah., gave but about 17 ounces, and this product was both lighter in color and more fluid than the last. It now became necessary to employ dry hickory wood as a fuel, to obtain flame and sufficient heat to drive over any further portions of the residue remaining in the alembic.

It will be seen that we have already accounted for over 75 per cent. of the whole quantity taken. There was a loss on the whole process of about 10 per cent., made up, in part, of a coaly residue that remained in the alembic, and partly of the unavoidable loss resulting from the necessity of removing the oil twice from the alembic, during the process of distillation, in order to change the arrangements of the thermometer, and provide means of measuring a heat higher than that originally contemplated.

About 15 per cent. of a very thick, dark oil, completed this experiment. This last product, which came off slowly at about 750° Fah., is thicker and darker than the original oil, and when cold is filled with a dense mass of pearly crystals. These are Paraffine, a peculiar product of the destructive distillation of many bodies in the organic kingdom. This substance may be separated, and obtained as a white body, resembling fine spermaceti, and from it beautiful candles have been made. The oil in which the crystals float is of a very dark color, and by reflected light is blackish green, like the original crude product. Although it distills at so high a temperature, it boils at a point not very different from the denser products of the first distillation. The Paraffine, with which this portion of the oil abounds, does not exist ready-formed in the original crude product, but it is a result of the high temperature employed in the process of distillation by which the elements are newly arranged.

I am not prepared to say, without further investigation, that it would be desirable for the Company to manufacture this product in a pure state, fit for producing candles, (a somewhat elaborate chemical process,) but I may add that, should it be desirable to do so, the quantity of this substance produced may probably be very largely increased, by means which it is now unnecessary to mention.

Paraffine derives its name from the unalterable nature of the substance, under the most powerful chemical agents. It is white, in brilliant scales of a greasy lustre; it melts at about 115°, and boils at over 700° Fah.; it dissolves in boiling alcohol and ether, and burns in the air with a brilliant flame. Associated

with Paraffine are portions of a very volatile oil, *Eupione*, which boils at a lower temperature, and by its presence renders the boiling point of the mixture difficult to determine. I consider this point worthy of further examination than I have been able at present to give it, *i. e.*, whether the last third, and possibly the last half, of the Petroleum may not be advantageously so treated as to produce from it the largest amount of Paraffine which it is able to produce.

The result of this graduated distillation, at a high temperature, is that we have obtained over 90 per cent. of the whole crude product in a series of oils, having valuable properties, although not all equally fitted for illumination and lubrication.

A second distillation of a portion of the product, which came over in the latter stages of the process, (a portion distilled at about 650° Fah., and having a high color,) gave us a thin oil of density about .750°, of light yellow color and faint odor.

It is safe to add that, by the original distillation, about 50 per cent. of the Crude oil is obtained in a state fit for use as an illuminator without further preparation than simple clarification by boiling a short time with water.

DISTILLATION BY HIGH STEAM.

Bearing in mind that by aid of high steam, at an elevated temperature, many distillations in the arts are effected which cannot be so well accomplished by dry heat, I thought to apply this method in case of the present research. Instances of this mode of distillation are in the new process for Stearine candles, and in the preparation of Rosin Oil. I accordingly arranged my retort in such a manner that I could admit a jet of high steam into the boiler, and almost at the bottom of the contained Petroleum. I was, however, unable to command a jet of steam above 275° to 290° Fah., and, although this produced abundant distillation, it did not effect a separation of the several products, and the fluid distilled had much the some appearance as the Petroleum itself, thick and turbid, As this trial was made late in the investigation, I have been unable to give it a satisfactory issue, chiefly for want of steam of a proper temperature. But I suggest, for the consideration of the Company, the propriety of availing themselves of the experience already existing on this subject, and particularly among those who are concerned in the distillation of Rosin Oil—a product having many analogies with Petroleum in respect to its manufacture.

USE OF THE NAPHTHA FOR ILLUMINATION.

Many fruitless experiments have been made in the course of this investigation which it is needless to recount. I will, therefore, only state those results which are of value.

1.—I have found that the only lamp in which this oil can be successfully burned, is the Camphene lamp, or one having a button to form the flame, and an external cone to direct the current of air, as is now usual in all lamps designed to burn either Camphene, Rosin Oil, Sylvic Oil, or any other similar product.

2.—As the distilled products of Petroleum are nearly or quite insoluble in alcohol, burning fluid (*i. e.*, a solution of the oil in alcohol) cannot be manufactured from it.

3.—As a consequence, the oil cannot be burned in a hand lamp, since, with an unprotected wick, it smokes badly. Neither can it be burned in a Carcel's mechanical lamp, because a portion of the oil being more volatile than the rest, rises in vapor on the elevated wick required in that lamp, and so causes it to smoke.

I have found all the products of distillation from the copper still capable of burning well in the Camphene lamp, except the last third or fourth part, (*i. e.*, that portion which came off at 700° F. and rising, and which was thick with the crystals of Paraffine.) Freed from acidity by boiling on water, the oils of this distillation burned for 12 hours without injuriously coating the wick, and without smoke. The wick may be elevated considerably above the level required for Camphene, without any danger of smoking, and the oil shows no signs of crusting the wick tubes with a coating of Rosin, such as happens in the case of Camphene, and occasions so much inconveniences. The light from rectified Naphtha is pure and white without odor. The rate of consuption is less than half that of Camphene, or Rosin oil. The Imperial pint of 20 fluid ounces, was the one employed—a gallon contains 160 such ounces. A Camphene lamp, with a wick one inch thick, consumed of rectified Naphtha in one hour, 1 3-4 ounces of fluid. A Carcel's mechanical lamp of 7-8 inch wick, consumed of best Sperm Oil, per hour, 2 ounces. A "Diamond Light" lamp, with "Sylvic Oil," and a wick 1 1-2 inch diameter, consumed, per hour, 4 ounces.

I have submitted the lamp burning petroleum to the inspection of the most experienced lampists who were accessible to me, and their testimony was, that the lamp burning this fluid gave as much light as any which they had seen, that the oil spent more economically, and the uniformity of the light was greater than in Camphene, burning for 12 hours without a sensible dimunition, and without smoke. I was, however, anxious to test the amount of light given, more accurately than could be done by a comparison of opinions. With your approbation I proceeded therefore to have constructed a *photometer*, or apparatus for the measurement of light, upon an improved plan. Messrs. Grunow, scientific artists of this city, undertook to construct this apparatus, and have done so to my entire satisfaction. This apparatus I shall describe elsewhere—its results only are interesting here. By its means I have brought the Petroleum light into rigid comparison with the most important means o artificial illumination. Let us briefly recapitulate the results of these.

PHOTOMETRIC EPXPERIMENTS.

The *unit* adopted for comparison of intensities of illumination is Judd's Patent Sixes Sperm Candle.

The Sperm Oil used was from Edward Mott Robinson, of New Bedford—the best winter Sperm remaining fluid at 32° Fah. The Colza Oil and Carcels's lamps were furnished by Dardonville, lampist, Broadway. New York.

The Gas used was that of the New Haven Gas-Light Co., made from best Newcastle coal, and of fair average quality.

The distance between the standard candle, and the illuminator sought to be determined, was constantly 150 inches—the Photometer traversed the graduated bar in such a manner as to read, at any point where equality of illumination was produced, the ratio between the two lights. I quote only single examples of the average results, and with as little detail as possible, but I should state that the operation of the Photometer was so satisfactory that we obtained constantly the same figures when operating in the same way, evening after evening, and the sensitiveness of the instrument was such that a difference of one half inch in its position was immediately detected in the comparative illumination of the two equal discs of light in the dark chamber. This is, I believe, a degree of accuracy not before obtained by a Photometer.

Table of illuminating power of various artificial lights compared with Judd's patent candle as a unit.

Source of Light.	Ratio to Candle.
Gas burning in Scotch fish-tail tips, 4 ft. to the hour.	1 : 5.4
" " " " " 6 " " .	1 : 7.55
" " Cornelius " " 6 " " .	1 : 6 2
" " English Argand burner 10 " " .	1 : 1.6
Rock Oil, burning in 1 inch wick Camphene lamp, consuming 1 3-4 ounces of fluid the hour	1 : 16.
Carcel's Mechanical Lamp, burning best Sperm Oil, 2 ounces fluid to the hour, wick ⅞ of an inch	1 : 7.8
Carcel's " " Colza Oil	1 : 7.5
Camphene Lamp, (same size as Rock Oil above,) burning best Camphene, 4 fluid ounces per hour	1 : 11.
"Diamond Light" by "Sylvic Oil," in 1 1.2 nch wick, 4 ounces per hour	1 : 8.1

From this table it will be seen that the Rock Oil Lamp was somewhat superior in illuminating power to Carcel's Lamp of the same size, burning the most costly of all oils. It was also equal to the "Diamond Light" from a lamp of one half greater power, and consequently is superior to it in the same ratio in lamps of equal power. The camphene lamp appears to be about one-fifth superior to it, but, on the other hand, the Rock Oil surpasses the Camphene by more than one half in economy of consumption, (*i. e.*, it does not consume one half so much fluid by measure,) and it burns more constantly. Compared with the Sylvic Oil and the Sperm, the Rock Oil gave on the ground glass diaphragm, the whitest disc of illumination, while in turn the Camphene was whiter than the Rock Oil light. By the use of screens of different colored glass, all inequalities of *color* were compensated in the use of the photometer, so that the intensity of light could be more accurately compared. Compared with Gas, the Rock Oil gave more light than any burner used except the costly Argand consuming ten feet of gas per hour. To compare the *cost* of these several fluids with each other we must know the price of the several articles, and this varies very much in different places. Thus, gas in New Haven costs $4 per 1,000 feet, and in New York $3.50 per 1,000, in Philadelphia $2,000, and in Boston about the same amount.

Such Sperm Oil as was used costs $2.50 per gallon, the Colza about $2, the Sylvic Oil 50 cents, and the Camphene 68 cents—no price has been fixed upon for the rectified Rock Oil.

I cannot refrain from expressing my satisfaction at the results of these photometric experiments, since they have given the Oil of your Company a much higher value as an illuminator than I had dared to hope.

USE OF THE ROCK OIL AS A LUBRICATOR FOR MACHINERY.

A portion of the rectified oil was sent to Boston to be tested upon a trial apparatus there, but I regret to say that the results have not been communicated to me yet. As this oil does not gum or become acid or rancid by exposure, it possesses in that, as well as in its wonderful resistance to extreme cold, important qualities for a lubricator.

CONCLUSION.

In conclusion, gentlemen, it appears to me that there is much ground for encouragement in the belief that your Company have in their possession a raw material from which, by simple and not expensive processes, they may manufacture very valuable products.

It is worthy of note that my experiments prove that nearly the *whole* of the raw product may be manufactured without waste, and this solely by a well directed process which is in practice one of the most simple of all chemical processes.

There are suggestions of a practical nature, as to the economy of your manufacture, when you are ready to begin operations, which I shall be happy to make, should the Company require it—meanwhile, I remain, gentlemen,

Your ob't servant,

B. SILLIMAN, JR.,

Professor of Chemistry in Yale College.

[Original Communication.]

Suggestions Upon the Nature of Heat.

BY A. GILKESON, OF NEW YORK.

[Concluded from page 67.]

Grove says, that heat, light, electricity, magnetism, chemical affinity, and motion, are all correlative, or have a reciprocal dependence. That neither taken abstractedly can be said to be the essential or the proximate cause of the others, but that either may, as a force, produce the others. He then says, that it is an irresistible inference that a force cannot originate otherwise than by generation from some antecedent force or forces. But he failed to tell us which one of these was the great antecedent force, of which the others were made the consequents. Again, he says, that motion may be again reproduced by the forces which have emanated from motion. And thus reasoning, he asserts that motion is invariably the immediate effect of heat; and viewing heat simply as to its effects upon inorganic matter, further asserts that it is motion. Prof. Tyndall, in one of his lectures on heat, gave two experiments, illustrating the correlative theory, which, when they are closely examined, will show that he cannot sustain his position by all the facts that he developed. The first experiment was with compressed air, which he let out of a vessel, and, striking against the face of a thermo-electric pile, produced cold. This he explains very ingeniously in this way, the air rushing out performs mechanical work, and the only agent it can call upon to perform it is the heat which it possesses; a portion of this heat will be consumed, and the air will become chilled, as is shown when it strikes the face of the pile. In the second the effect is different. When a current of air is urged from the nozzle of a common bellows against the pile, muscles perform the work, and the expelled air which strikes the face of the pile has its motion stopped, and an amount of heat equivalent to the destruction of this motion is instantly generated. In the one case cold is the result of the air's motion, and in the other heat is produced. Why should the destruction of force produce cold in the first experiment and heat in the second! The Professor says that the heat which the compressed air possesses is partially consumed in performing its mechanical work; that is, this heat takes the form of motion, leaving the air chilled, and when the current strikes the face of the pile cold is produced; but what has become of the arrested motion? According to his theory it must have reproduced heat—heat that was consumed in performing the work—then why did not this restored heat instantly remove the chillness of the air and produce a different effect on the pile? It made no difference whether the current of air received its motion from compression or muscular effort, the motion was the same, and when stopped must produce its equivalent in heat. For it required as much force to compress the air in the vessel as to urge it through the bellows, other things being equal.

Latent heat is defined as a form of potential energy, depending on the physical state of the substance in which it is stored up. Now, if potential energy require some outside force to convert it into actual energy it cannot be heat; for heat being the effect of motion becomes a form of force, and force cannot be active in one condition and inactive in another. Then if it be settled that heat is the effect of motion, there is no latent heat in bodies—that is, the matter of heat associated in a masked, or dormant state with ordinary matter, as latent heat is supposed to be. Heat then can exist in bodies in the form of motion only, and must be produced by some outside force.

The calorists have demonstrated that heat can be evolved from bodies by condensation or compression;

and the correlationists have shown that more heat can be produced by the forcible contact of bodies than it is possible for them to contain, as in the experiment of Rumford, and in the friction of machinery. One side says that heat is stored up in the pores of bodies —latent; and the other says that it is produced by motion.

The believers in the motion theory say that heat is produced in any quantity without flame, combustion, etc., as in melting two pieces of ice by rubbing them together, and also cases in which a quantity of heat disappears, as in freezing mixtures. Now in the case of the ice, *any* quantity cannot be produced, but a *sufficient* quantity to melt the ice is producible and no more, for when the two pieces are all rubbed into water, the source of the heat is exhausted. The water thus produced may absorb all the heat generated, and not have its temperature raised above that of the ice; for water, owing to the peculiar arrangement of its particles, is capable of absorbing heat at the freezing point, without a change of temperature. As to freezing mixtures, let us take one example. Chloride of sodium (common salt) and ice make a very powerful freezing mixture. In their combination, or rather double decomposition, what produces the cold, or, in other words, what becomes of the heat? The hydrogen of the ice having a much greater affinity for chlorine than for the oxygen, with which it is combined, leaves the oxygen and unites with the chlorine, forming hydrochloric acid. The sodium of the salt is left free to unite with the free oxygen, forming soda. Here we find hydrogen, the great decomposing agent, performing a double decomposition—first, by forsaking its associate, oxygen, in the ice, and then taking away the chlorine from the sodium. Now the force employed in tearing the old compounds apart and forming the new ones, should show itself in the form of heat, but unfortunately for the correlationists cold is produced. Upon the theory of Bacon and Newton, that heat is a substance, a satisfactory answer can be given to the question—what became of the heat? Heat being an ethereal substance filling the pores of all bodies, of course every atom of ponderable matter is surrounded with it, that is, every atom has an atmosphere of heat. By looking at the table of atomic weights it will be seen that chlorine is 36 compared with hydrogen as unity, that is, an atom of chlorine is 36 times larger than an atom of hydrogen; an atom of oxygen is only eight times larger; therefore the atoms of hydrogen being so small they have very deep atmospheres of heat, while the atoms of chlorine being so many times larger have very thin atmospheres—the specific heats of bodies being nearly inversely as their atomic weights. So on the principle, that those elements which have large atomic atmospheres of heat have a great attraction for those that have small atmospheres, hydrogen frees itself from oxygen, by which it is feebly held, and unites with chlorine. This is called chemical affinity. The atoms of chlorine having but a small amount of heat around them, absorb a great portion of the heat around the atoms of hydrogen, and cold is produced. Another point in favor of absorption is, that the atomic volume of the hydrochloric acid is not reduced

Bacon said heat was a substance, but without weight; he meant that it could not be weighed. If it is a quantitative substance, it has a weight of its own just as well as hydrogen or any other ponderable, but it cannot be weighed in its own element. Hydrogen cannot be weighed in hydrogen, but in a vacuum its weight can be ascertained. But as heat is an all-pervading, ethereal substance, and there being no material substance, no matter how fine its pores are, that is impervious to it, an absolute vacuum cannot be formed in which to weigh it.

Heat cannot be made up of minute particles which act upon each other, for that condition admits of a still finer substance to keep the particles in communication. It must be a dense medium without pores, and therefore incompressible. It is always in motion, for it is always seeking an equilibrium—points which have an excess of it are giving it off to those places that have but little of it, such as the sun, which is continually radiating heat. Thus the great motor in Nature is always employed. This principle is very clearly demonstrated by the nebular hypothesis. Heat was the agency by which our solar system was formed, and those who advocate the nebular theory speak of no other. Terrestrial magnetic storms are caused by changes in the sun's radiating power, and meteorologists have traced the cause of atmospheric phenomena to these changes. Geologists have proved that heat is the cause of volcanoes, earthquakes, and hot springs, and all changes taking place in the earth. Botanists have shown that vegetables and plants are germinated and nurtured by this same agency. Physiologists and Naturalists have made it clear that all animals from the lowest form of life up to man exist by virtue of this great life principle. When we shall have unravelled every mystery of Nature, and learned the true cause of all its phenomena, we shall not doubt that heat is its great animating principle—the cause of all changes, and therefore the cause of motion.

British Association of Gas Managers, June 14, 1871.

[Continued from page 68.]

Mr. R. P. Spice said the subject introduced by the paper for discussion branched out into so many topics that it was difficult to compress the remarks he desired to make into any reasonable limit. With regard to the apparent discrepancy in the statements made, he might point out that Mr. Baker appeared to have taken four months experience with a particular kind of coal, and to have estimated the return for the year on that basis, rather than to give an actual result throughout twelve months. Referring to the returns given by Mr. Eldridge and Mr. Stout, it would seem that where operations were carried out for converting the ammoniacal liquor of gas works into sulphate of ammonia there was a profit of about 1s. for every ton of coal carbonized. It had been said that under some circumstances a return of something like 2s. per ton was attainable. This was a large result, and came very nearly up to what Mr. Baker mentioned. There were a variety of ways of accounting for differences of such an extreme character. He (Mr. Spice) had paid a great deal of attention to the subject of scrubbers, and the result of his experience and observation was that, as a rule, they were either too low or too wide—that the diameter was too great, or the height not great enough. It was necessary that the scrubber should be so constructed as to give a shower of liquor (not water—he abhorred water in gas works, for when used it threw down the hydrocarbons contained in the gas, whereas when liquor was used the illuminating power was not deteriorated, and no offensive results ensued). Every gas manager might with safety bring up the strength of his liquor by passing it through a scrubber designed to suit his works, to 18 ozs. Mr. Stout had now a more powerful scrubber on his works than formerly, and no doubt he would be able to show better results during the next twelve months. With regard to the use of scrubbers generally, a previous speaker asked whether it was worth while to put up one for the sake of making the ammoniacal liquor stronger. He (Mr. Spice) could not understand why any gas works should be without a scrubber. He did not think much of the use of water in a still, as the particles of gas did not come effectively in contact with the particles of water. He preferred a continuous shower of ammoniacal liquor through a scrubber. The scrubber at Mr. Stout's works was 30 feet high and 10 feet in diameter, and there was a constant stream flowing through. There were five sieves, and the material employed was nine inches in depth, composed of broken glass and pottery ware. The space between the surface of pottery and the bottom of the next sieve above it was for the gas to tumble about. This he held to be a valuable point, for the gas should have room to twist and turn about, so that every particle of it should come in contact with the liquor, and become thoroughly wetted therewith. It was next to impossible to work a scrubber properly without the aid of steam, or it would become choked with tar, thus increasing the pressure on the retorts and otherwise become objectionable. A small steam apparatus could be put up at a comparatively trifling expense, and be worked without any cost. However small works might be, it was desirable to have a scrubber and a steam-engine, and having these he did not see why there should not be also an exhauster. Step by step he had arrived at the conclusion that the right things to have were clay retorts, exhausters, and scrubbers, and that where the liquor could not be sold it should be converted into sulphate. Gas ought never to be sent out now-a-days, as it sometimes was, charged with ammonia. The ammonia ought to be kept at home and utilized.

Mr. Price said he had followed out a plan very similar to Mr. Eldridge's, and having calculated cost and returns, he found that he realized a profit of cent. per cent. He wished Mr. Eldridge to inform the meeting what means he employed for getting rid of the fumes arising from the manufacture of sulphate of ammonia.

Mr. Stout said he omitted to make one remark which he had intended as an encouragement, namely, that it frequently happened there were other small works to be found in the neighborhood, the managers of which would be glad to sell their liquor at a low price, so as to make it worth while to undertake this branch of manufacture. With reference to the discrepancy in some of the statements made as to the amount of profit upon the article, a great deal depended upon the labor, fuel, and carriage against the receipts, whereas another probably included every item of outlay, which, of course, was the proper mode of determining the value of the process.

Mr. Greenfield (Torquay) said, from what he gathered in the course of the conversation, Mr. Eldridge worked up to 12 and 16 oz. liquor. Perhaps the gentleman who spoke on the other side had two scrubbers, and passed through the second the liquor which had been through the first. He would be glad to learn whether any of the members had had any experience in sending jets of steam through the apparatus.

Mr. Lane said it appeared to be taken for granted that there were great discrepancies in the results. He could not see that there were any, and he believed the apparent differences arose from the different qualities of coals used. It would seem that Mr. Baker made a little over six tons of sulphate per 100 tons of coal carbonized, which was about the same return as that obtained at Boston. The whole difference really amounted only to 10 per cent., which, as he said, might easily be accounted for by the variation in the coals, and probably by a more elaborate system of washing.

Mr. Hodgson Jones rather differed from Mr. Spice as to water not being allowed to come in contact with gas. He was accustomed to scrub gas with liquor through two scrubbers in the manner described, and after that he passed it through a third scrubber, in which water was employed. He found in many towns to which he went that there was ammonia in the gas. Where lime was used for purification there was no fear of taking too much of the ammonia out.

Mr. G. Anderson said he was about the first person to manufacture sulphate of ammonia from gas liquor in London, having commenced it at the Surrey Consumers Gas Works eighteen years ago, when other managers were sending it away in barges. The process which Mr. Eldridge had described was a nice, simple, and easy one, which almost any gas manager could adopt. There was only one very small objection to it, namely, that unless there was a water-trap, the products which came from the saturator and ascended the chimney were liable to explosion, and that, in any case, the combustion of those gases in the chimney caused an unpleasant smell, sometimes not so much at the works as at a short distance from the works. There was a mode of getting rid of that objection, which was this: instead of causing the vapors to pass from the close saturator into the chimney, to condense them, as was done in a highly satisfactory manner at the Crystal Palace District Gas Works. They might all be reduced into a dirty curious liquid, the exact elements of which chemists had not yet defined. A difference of opinion had been expressed as to the proper strength of the liquor, that is, whether sulphate could be best prepared from a heavy or light liquor. He quite agreed in what had been said as to the value of the liquor to the manufacturer being greater in proportion to the quantity of ammonia it contained per gallon, if the liquor were not too strong; but, from experiments he had made lately, and which had been subsequently confirmed, he was prepared to state that, if sulphate were made from very strong liquor—say, of 20 to 25 oz. (which it might be by washing and scrubbing)—it required from 30 to 40 per cent. more acid per ton of sulphate made than if a weaker liquor were employed. He did not mean to say there was any ammonia lost, inasmuch as a gallon of strong liquor would make more than a gallon of weak. The number of gallons of liquor necessary to make a ton of sulphate would be more with weak liquor than with strong, but the number of pounds of acid to make a ton would be less with the former than with the latter. The explanation of this might be that there were acids in the liquor which assisted in the manufacture—carbonic acid was one—and that with all the washing and scrubbing which might be given to the gas, the proportion of these acids was no more whether the liquor were strong or weak. He was sorry to differ from Mr. Spice, but he was bound to say he was totally at variance with him as to the value of water in washing gas. He could say all that Mr. Spice had said, but he must say it with a circumstance. He could say that the washing of gas with pure water threw down the hydrocarbons, but he must add that this arose from washing with an improper quantity. He had after many years experience arrived at the conclusion, and he was perfectly confident on the point, that nobody should think of saying his gas was purified after simply washing it with ammoniacal liquor. On this point he would speak as strongly as possible. He asserted that when gas had become nearly purified from ammonia, to bring it into contact with a liquid highly charged with ammonia, it was much more likely to take ammonia from the liquid than to yield up any small remaining portions it might previously have contained. The way to purify gas was first to condense it well, having as little use for steam in the scrubber as possible; then to introduce it into the ammoniacal liquor of the works, which he would suppose to be about 5° Twaddle, requiring 10 ozs. of acid per gallon to neutralize it. If this were done the water in the washer would increase in strength so as to require nearly double the quantity of acid to saturate the ammonia. In his practice the gas was passed from the washer through a scrubber supplied with pure water at the rate of ten gallons per ton of coals carbonized—or, in other words, about double the volume of his ammoniacal liquor. This ten gallons he could not put on in a constant stream, because such a stream would be very small and would do very little good, as it would trickle down the interstices of

the scrubber, finding for itself a passage in the easiest way; while the gas would pass up where there was least resistance, and consequently come but slightly in contact with the water. He therefore supplied the water as a douche by means of a self-acting tumbler, on the principle of a Barker's mill, by which he obtained a very equal distribution of the water, and he found that going in at the top of the scrubber pure it came out at the bottom 5 or 6 oz. liquor. That liquor ran into the ordinary ammoniacal liquor-tank of the works, and was a part of that which, in subsequent operations, was pumped into the washer. On the previous day, it was mentioned that at his old works, at Dover, he did not employ the apparatus described, and that the difference between the gas from the old and new works could be always observed, although the gas was made from the same coal and purified in the same manner. Clearly, therefore, the hydrocarbons were not thrown down by the use of pure water, because at the old works it was not used and at the new works it was.

Mr. Garnett said in the works under his superintendence, at Ryde, he was placed in such a position that he was not permitted by the local board to manufacture sulphate. But with reference to the value of scrubbers, and the pumping of ammoniacal liquor through them, he might mention that, when he had occasion to stop his pumping apparatus for repairs or otherwise, he found an increase of one-third in the cost of his purification. In answer to Mr. Foulis, he stated that he was obliged, from the circumstances in which his works were conducted, to purify by lime, as there would be a strong objection in the locality to the revivifying of oxide. His purifiers were all on the upper floors, with openings in each floor, and at five o'clock in the morning he had to get carts for miles round sometimes to remove the refuse lime.

Mr. Eldridge, in reply, said a part of the discrepancy between the returns of sulphate spoken of might be accounted for by the fact that last year, in consequence of great difficulty in disposing of tar at his works, he threw away enough liquor to make a couple of tons more than he had shown. This year, during the first five months, he had made twenty tons, so that the results would be more favorable. With reference to Mr. Price's inquiry, he might state that when he first started his apparatus there was sometimes a little offensive smell, and one or two complaints reached him from persons half a mile from the works. No doubt in dense weather there would be a slight smell from the chimney. He had thought that this might be remedied by having a pipe brought from the cover of the saturator into a trough of water with a dip, and a little burner on the top of the pipe to burn off any gases. The suggestion made by Mr. Anderson on this point was valuable, and he was thankful so much information had been elicited during the discussion.

[To be continued.]

Aniline Colors in Paper Manufacture.

One hundred pounds of coal will yield under favorable circumstances, 10¾ pounds of tar, 8½ ounces tar naphtha, 3 ounces benzole, 4½ ounces nitro-benzole, 2½ ounces aniline.

The value of the yearly production of aniline colors, is now estimated at five million dollars, of which the chief manufacture is confined to Germany and Switzerland. The principal consumption of the aniline colors is for wool and silk goods. Cotton and linen require mordants and are more difficult to dye.

Aniline colors are not properly substantive, that is, such as attach themselves directly to fabrics, but are adjective, that is, requiring mordants to fix them. For coloring paper, only substantive dyes, with good covering properties, are applicable, and for this purpose precipitated colors are usually taken, such as Prussian blue, chromate of lead or finely pulverized earth, such as ochre, green earth, and Bremen green.

It is advisable to render the paper stock as substantive as possible by adding China clay and other earthy matter, and to employ the aniline colors which are soluble in water. For every ounce of aniline color take an equal quantity of hydrochloric acid, free of iron, to make it thoroughly acid; then add one pound of hot water and boil for ten minutes, and filter through a woolen bag. It is a saving of time and labor to take a pound of aniline color, thirty pounds of water and one pound of hydrochloric acid at one operation.

As an illustration, suppose we wish to make rose-red wrapping paper, to 100 pounds of stock we should take 1½ ounces fuchsine, 20 pounds of China clay, previously prepared with starch, and thoroughly mixed until the color is uniform. Among the colors that have been tried with success may be mentioned white, iodine violet, fuchsine, aniline blue, red brown; and on the other hand, yellow colors and coraline do not work well.

Correspondence.

[Correspondents, in all cases, should sign their communications with their names and address in full—not necessarily for publication, but as a guarantee of good faith.—Eds.

Accuracy of Gas Meters.

[We publish below, in part, a communication from an old and valued contributor, on this subject, being all that part which relates to the subject matter in hand. The introductory remarks of our correspondent appear to us altogether too personal in tenor to be useful or appropriate in a controversy on a scientific or technical subject. In such a case it is wholly unnecessary to depart from the courtesies and amenities which would doubtless be adhered to in an oral discussion between the parties.]

TIFFIN, OHIO, August 29, 1871.

Mr. Editor: * * * * In Mr. Keeling's letter on gas meters, copied in the *American Artisan* of July 24th, he says: "and as a rule, the consumer always suffers for the shortcomings of the meter." I flatly deny this assertion, for while I admit the truth of the cases he cites, I ask him what if a meter has been proved in a dry condition of apparatus, after having been drying on the makers shelves, when it is placed in a cold damp cellar, will the diaphragms not stretch, and the meter register slow in proportion? Again, does not the continued action gradually crack, and eventually destroy the diaphragm, like an old shoe; and from the moment of the first crack the consumer burns gas for which he does not pay, and so on, until the meter will not register anything, and is condemned, which may be months, or even years.

Now, of the wet meter of which Mr. Keeling does not notice the use, or even the existence, there are no variations in that; and when the meter is properly filled, even Mr. K. will not deny its accuracy; but when the water begins to evaporate, what is the result? Why for all the fluid evaporated the consumer burns an equal quantity of gas at every revolution of the drum. What truth then is there in the assertion of Mr. K. "that as a rule, the consumer always suffers for the shortcomings of the meter." I think the experience of Mr. K. is very small, or he is very "inexact."

Further Mr. K. says "give the consumer a means of testing the meter, independent of the gas companies or their agents," * * * * "but where are you to go if you suspect your gas meter." I would reply to him that in many States the government has appointed inspectors for that very purpose, at the expense of the gas companies. He does not seem to be aware of this.

And I would further inform him, that each consumer can test his meter (approximatively) at any time, by a burner consuming any given number of feet per hur (which burners the GAS-LIGHT JOURNAL might supply to consumers), and thus be fully satisfied; but Mr. K. with such fecundity of ideas, makes no such practical suggestion.

In conclusion, what does the annual report of the several State Gas Commissioners show. You have them, and can verify what I have before published in your columns, namely, that of all old meters tested, about the same number are in favor of the consumer as the gas companies, and at nearly the same per centage; and thus the officers appointed for the protection of the public contradict the assertion of Mr. K., and I would respectfully suggest that he examine the said reports.

In his letter of August 7th he gives notice that he has discovered a means of dispensing with the standdip and hydraulic—good. I hope he has, for that might partially compensate for the mischief his wild assertions, sown broadcast, create between gas-makers and consumers. We wait the demonstration, but we will suppose he has. Is it true that it "will save 56 per cent. of the cost of fitting up a retort house"? You know that would not save 10 per cent. I close by calling on Mr. K. to controvert what I have stated, if in his power to do so. Yours respectfully,

JOHN GWYNN.

Complimentary.

[Our remarks (August 2nd) on the British Patent Laws have elicited the following rather complimentary note from the Chairman of the recent meeting of British Patent Solicitors.—Ed.]

SOUTHAMPTON BUILDINGS,
LONDON, Aug. 15, 1871.

Professor H. WURTZ.

Dear Sir: I am obliged to you for the article in the GAS-LIGHT JOURNAL. It is one of the fairest and ablest criticisms the resolutions have received. It is impossible for me to correct all the misunderstandings, or to write to the Journals, otherwise I should ask for a little space to explain the meaning of the sixth resolution. It is not intended to exclude "Experts" from the court, only not to have them as witnesses. The wording of the sixth resolution is most unfortunate, and we have modified it. It is our idea that the Experts should be the Judge's assistants, and not witnesses for either side. I think you will agree with us that this change would be desirable. The wording of the original should have been "*expert witnesses.*" We do not think jurors as such are of any earthly use in patent suits. The Judge and his scientific advisers should constitute the tribunal. The system of examination may answer in the United States, but it cannot, we believe, be introduced to advantage in this country. The French system works well in practice, and their courts are the best in the world for the patentee. No claims are required or desirable in the specification, as in their absence the Court will sustain whatever is new in the specification. Your article will be quoted in substance by some of our journals. Yours very truly,

GEORGE HASELTINE.

[Enclosed in the above were several printed slips, which are of interest in this connection.—Ed.]

The Coal Measures of Wyoming Territory.

In western Wyoming, 436 miles from Cheyenne, is Evanston, a new, thriving town, destined to become a point of some note. It has handsome streets and fine looking buildings. The leading industry of Evanston is its coal mines. The best coal of the territory is found here, an analysis of which gives the following result:

Carbon	72.16
Ashes	2.50
Sulphur	none
Water	3.34
Volatile matter	22.00
	100.00

The outcrops along Bear river occur in several veins, one of which is fifteen feet thick. This vein is a mass of pure coal without admixture of slate, earth, rock, or any other substance deleterious to its quality. These mines are now shipping about 400 tons per day. The western division of the Union Pacific, the Central Pacific, the Northern portions of Utah and Nevada, and the cities of San Francisco, Salt Lake and Omaha use large quantities of this coal.

There are several towns along the line of the Union Pacific Railroad which are essentially coal towns, and owe their existence to the mines; and this fact brings us to a discussion of coal in Wyoming.

The coal measures of this territory cover an area of about 100,000 square miles. A local paper, referring to the discoveries made, says: "The whole country, from a point one hundred miles west of Cheyenne to the extreme western boundary of the territory, is underlaid with one immense layer of coal, at an average depth of eighty feet." These deposits cover an area of at least one hundred square miles north of the railroad line. Along the north Platte and the Sweetwater abundant evidences of coal exist, and it occurs in bold outcroppings in numerous places. This is likewise true of the northern and north-western portion of Wyoming. Although the latter portion of the territory has not been fully explored, it is known that valuable deposits exist in the vicinity of Forts Reno and Phil. Kearney. The presence of Indians precludes the occupation and development of these coal deposits. It will be seen from this that the Wyoming coal region

are greater in extent than those of Pennsylvania, and equal in area to all yet discovered west of the Wabash, and south of the Ohio river.

The area occupied by the Laramie basin is about 5,000 square miles. The beds are from five to eleven feet thick. The most eastern limit over which coal has been found is ten miles east of Rock creek, a branch of the Medicine Bow river; and its most westerly limit is the boundary-line of the territory. There are outcroppings along Rock creek, Medicine Bow, North Platte, Muddy creek, Bitter creek, Echo canon, and the Weber river, to Salt Lake city. The continuation of the lignite deposits of the Upper Missouri has been traced eighty miles above Fort Laramie.

The mines now being worked are along the Union Pacific railroad, at different points between Laramie and Wahsatch. The first that we come to, in going west, is the Carbon mine, 140 miles west of Cheyenne. The coal here is reached by a perpendicular shaft seventy feet in depth. The vein is from six to nine feet. The daily product was three hundred tons until the unfortunate accident in November last, when the mine was burnt out. A new shaft has been sunk, and the delivery of coal will soon exceed the former quantity. The middle division of the Union Pacific and the Denver Pacific railroad were, to a great extent, supplied from this source, until the opening of a railroad to the Briggs bank, in Boulder County, Colorado, when the Denver Pacific began to seek its fuel at that point. The Carbon coal is the best for making gas that has been found in the territories: the works at Denver and Omaha are using it. Hallville, 283 miles west of Cheyenne, is on Bitter creek, Carter county. There are two workable veins here—the upper ten, and the lower six feet thick—with a stratum of soapstone between. The coal is of great purity and used mostly for domestic purposes. Fifteen thousand tons of this coal were sold in Omaha the past year. Forty miles west of Hallville is the Vandyke mine. This coal is used all through the territories for steam and blacksmithing purposes. Eighty thousand tons of it were consumed in the machine-shops at Omaha during last year. Nine miles east of the Vandyke mine are Rock springs. Here is an open drift mine, in the side of a hill, an eight-feet vein. The product is about 3,500 tons a month.

All the coal banks in Wyoming are now producing a total of about 1,500 tons a day. New openings are being made at various points. Analyses of two different beds give the following result:

	Point of Rocks.	Rock Creek
Carbon	64.70	61.34
Ash	4.40	1.50
Sulphur	0.42	2.00
Volatile matter	30.48	35.16
	100.00	100.00

Wyoming coal is the best west of the Missouri, except that of Boulder county, Colorado. In general heating properties, in freedom from sulphur, and in impassive resistance to atmospheric influence, it is certainly superior. A late number of a Philadelphia journal, commenting on its merits, says: "It is claimed that it will make more steam than the same quantity of Lehigh coal; that it is better for domestic uses, or for propelling machinery, and especially for gas generation, averaging 10,000 feet per ton, while Pittsburgh coal averages only 8,500. It has less waste, showing a smaller proportion of ashes and clinkers. It is said that while on the Pennsylvania Central railroad a ton of anthracite will run an engine forty miles, a ton of Wyoming coal will propel it at least seventy-five miles. It is said, also, to excel anthracite as a smelting coal, being used with great success at Omaha in making iron: it adds to the grain and toughness of the metal."—*Am. Exch. and Review.*

Smedberg's "Synopsis."

The following additional subscribers to the abov work are herewith acknowledged, making 348:

D. H. Van Anken, Eng'r Cohoes Water Power Co., New York.

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RECENT AMERICAN PATENTS.

Pertaining to the Specialties of this Journal, for the two weeks ending Sept. 16, 1871.

118,183.—Exhaust Chamber, Etc.—J. Becker, Chickies, Pa.
118,221.—Gas Meter.—H. H. Edgerton, Fort Wayne, Ind.
118,239.—Extinguishing Lights.—C. H. Harwood, Salem, Mass.
118,302.—Carbureter.—O. Tirrill, Brooklyn, N. Y.
118,355.—Gasolier.—C. Deaves, New York city.
118,459.—Hydrocarbon Gas.—J. Kidd, New York city.
118,472.—Gas.—P. Munzinger, Philadelphia, Pa.
118,676.—Gas.—A. L. Ambler, Washington, D. C.
118,579.—Gas.—J. A. Bassett, Salem, Mass.
118,608.—Gas Seal.—A. F. Havens, Brooklyn, N. Y.
118,669.—Gas Lighter.—M. Andrew, New York city.
118,702.—Generator.—R. W. Dugan, Covington, Ky., and B. F. Clark, Cairo, Ill.
118,709.—Gas Pump.—W. Foster, Brooklyn, N. Y.
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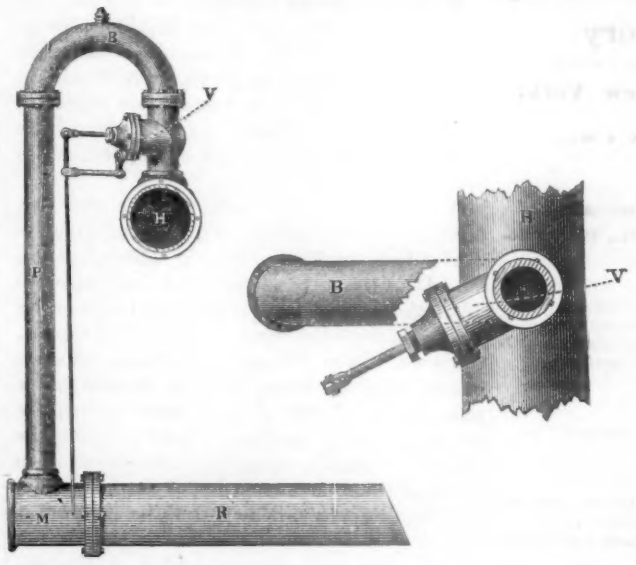

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AND

Chemical Repertory,

PUBLISHED ON THE 2D AND 16TH OF EACH MONTH,

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SATURDAY, SEPTEMBER 16, 1871.

WISHING TO MAKE THIS JOURNAL an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit letters from all among them who make the study of these subjects a pleasure, or a profession.

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General Editorials.

OUR PROPOSED SCHOOL OF GAS.

We have as yet no response to to our proposal made a month since that there should be established, in or near the metropolis, a scientific School of Gas, in which young men should be trained to the work of conducting this important branch of human industry. Let us give a little consideration to the amount of importance involved in our proposition.

We have special scientific schools now pertaining to many branches of human industry; to Agriculture, to Engineering, to Mining and so on. Does Gas yield so greatly in importance to all of these that it should be treated with entire neglect in the educational world? Far from it, think we. Take Mining for example, and without disparaging this great art, we believe that a reflective mind will at once admit, when the question is fairly considered, that not only is the amount of human capital and labor involved in the production, and extension of the production, of Gas, quite comparable with those involved in Mining, but that the number of human beings directly (not indirectly) interested in the perfection and economy of the gas manufacture is *far greater* than in the other case.

This latter consideration will strike many with novelty, but is it not undeniable? In fact can it it be said that there is one individual in any of our larger communities who is not in some degree affected by the cost of the illunating power which is drawn from the gas retort. Even those who are denied the pleasure of paying gas bills themselves, still have taxes to pay, for that which serves to illuminate the general body politic.

It may also be very reasonably maintained that the growth in importance of our interest is probably greater in proportion than in that of mining, inasmuch as it is well known that a larger, that is a denser population, in any country, or district thereof, always involves an enormously greater increase (indeed in a large geometrical ratio) of gas consumption. The reasons for this are obvious on a little consideration. Improvements in economy and quality of production therefore, concern populous countries in a greater degree. On Manhattan Island alone, a saving of one quarter of the cost of the gas burned, would amount to not far from $2,000,000 per year.

The fundamental question may be asked, and very properly: Are there a sufficient number of "openings" in the land for the considerable number of Gas Experts that would in the course of years be turned out by such a school? We most deliberately and positively believe that there are. In the United States there are now probably seven hundred gas companies, at least five hundred of which are of sufficient importance to call for the services of at least one trained manager. The larger companies should have a staff of such experts, numerous in proportion to their magnitude. Then there would be a foreign demand for such trained experts. All inspectors and examiners of gas, meters, burners, and other gas apparatus, should be qualified by such an education as we have marked out. Are we not justified by these data in our conclusion that there is, or *should be*, a sufficient demand for such education? We have thrown out these ideas, occupying all the space available at present, hoping that our views may receive some attention from the highly intelligent and interested circle of our readers, but shall return again and again to the charge.

THE "PSYCHIC FORCE."

As inquiries multiply, regarding the meaning of this new "dissonant-consonant" term in scientific literature, we attempt a reply, which may quiet some inquisitive souls. To us it clearly implies that force by which jugglers or "prestidigitateurs" (by some called mountebanks) amuse the children. We must now, however, designate these gentlemen Psychists, Professors of Psychism, and so on. The new term means literally Soul-Force. "What's in a name?"

It is already projected, by a reliable gentleman, of scientific status, to establish a new Society devoted to the study and practice of these arts. We protest against this new Society, as we fear that, like all the rest of the romance of our childhood, the mystery, and therefore the charm, of the eggs fried in the hat, of the chicken hatched out in the "Professor's" mouth, and all that sort of miraculous and delightful thing, will in this way soon be sent in the track of most other mystic things of eld, and be reduced to mere stupid science, *if not* psychism. About these things we don't want to be enlightened. Even telephonic music, on an *accordeon* or any other instrument, would please us more if we did'nt understand how it was done.

We must ask, however, while on this subject, and whereas "animal magnetism" will be classed under this head, why the term "odic" force, of the celebrated Reichenbach, is not entitled to precedence. By the way, it seems to us that if this *be* thus, there is probably a peculiar, perhaps a lower, form or "mode" of this force, such as we may suppose exerted by fortune-tellers, "seventh daughters of seventh daughters," advertisers in the *Sunday Mercury*, and so on, which, by an application of principles of chemical nomenclature, we may designate as an *odious* force. However, we do not urge this latter discovery of *ours*; in fact we withdraw it altogether, out of regard to the memory of the discoverer of paraffine, who, whatever his faults, doubtles possessed the animus and honor of a true scientist. *Semel insanivimus omnes.*

One more notion, and we have done with the new "force," we hope forever. "Clairvoyance" will be found to be "psychic" in its nature. We would respectfully submit to the new Society (*in posse*) whether some astonishing cases of almost simultaneous publication, even in almost the same phraseology, of scientific discoveries and inventions, in two distant countries, have been due to "psychic" power or action? Some readers will acquit the present writer of absurdity in asking this question.

THE LONDON REFEREES ON GAS BURNERS.

In this issue we present the first instalment of an abstract of the London Referees' first Report on Burners, to which we shall give more space in our next, and shall comment on it from time to time. Some criticisms of the London *Journal of Gas-Lighting* will furnish us a text at present. Our contemporary treats the labors of the referees with a severity which somewhat surprises us, and which we can only account for by supposing that the British gas-manufacturing interest is bitterly inimical to the referees and to the new system under which they were appointed. If this be so, the course of that journal, as the mouthpiece of the gas interest (and, as such, caring rather less than nothing for the general public), is plain.

It says: "With the construction of burners

we do not know that they have any call to busy themselves" and that the Report treats us only to "a mass of elementary information respecting burners * * * well known to every one having practical acquaintance with gas, and for the most part to every well-instructed schoolboy." Further, that "Beyond a few crude speculations, almost everything in the report has been put before the public over and over again, although not, it is true, in this verbose and pseudo-scientific-form. The substance of the report, stripped of its wordy dis guise, might have been expressed in half a dozen sentences. Freed from all verbosity and confusion, the conclusions come to, so far as burners are concerned, are that the luminosity of a gas-flame depends upon the air supply, which in naked flames is regulated by the pressure at which the gas issues from the burner, and in Argands is controlled (in part, we would say) by the chimney. These facts are perfectly well known, if not fully understood, by every one conversant with the subject of gas-burners; but the principles involved have been but little applied in practice, and hence we have good burners and bad burners, the latter, unfortunately, predominating in number. It is the self-imposed duty of the referees to tell us how good burners are to be constructed, and when they have done so they will deserve the best thanks of all who did not know before": and still further on, that "in concluding, for the present, we must press on the referees the propriety of completing their investigations on the subject of burners at the earliest possible date, so that the multitude of bad burners at present in use may be quickly discarded."

These comments are trenchant, but seem to us very largely unjust. Like most hypercriticism, founded on prejudice, they are inconsistent and overreaching. If the principles *are* "well-known to schoolboys," why is it that they "have been little applied in practice?" And if the referees have no "call to busy themselves" with the construction of burners, why are they so earnestly called on in conclusion to complete their investigations?

Looking at the matter, as we can, from a cisatlantic point of view, and with unprejudiced eye, it seems to us that the referees could not well be engaged, for the *public* weal, in a better work; and if we understand aright, they are public officers, whose duty is to see that justice is done to both consumer and producer, and not to devote themselves to investigations for the behoof of the latter alone. As to the accusation, therefore, of being "pseudo-scientific," it is plain that as the document is not addressed exclusively to gas-experts, it is altogether appropriate for them to divest the subject as much as possible of technicalities of language, and from this some diffuseness always inevitably arises.

But this apart, we do not concur that all these things are so excessively familiar to all students of gas, much less to *any* schoolboys; but our own observation has shown us that there is scarce any subject, of equal practical importance, which is less clearly apprehended (in a practical way we mean) by many well-read gas-men, and which many of the most intelligent of this class would like better to have ventilated, elucidated and reduced to plainness and precision, in a way somewhat like that of the referees.

It may be that these gentlemen have possibly arrogated to themselves incorrectly some things known to scientific men before June last, but it be remembered that they commence by stating that their starting point in these experiments was two years previous to this date, snd several mp ortant papers have appeared within this peiod from other sources.

Our words to the referees, if they were likely to hear them, would be words of encouragement and commendation. Among the criticisms referred to are other passages, yet unquoted, which appear to us much more likely to be deemed pseudo-scientific than anything of the referees, aud these we may bring up at another time.

THE PATENT LAWS OF ENGLAND.

At a recent meeting of London Patent Agents, held to consider the proposed changes in the patent laws, George Haseltine, M. A., chairman, it was resolved:

1st. That inventors have a *right* to the sole use of their inventions, which it is the duty of legislators to harmonize with the interests of the State.

2nd. That patents should no longer be granted to mere "*first importers*," but should be confined to actual inventors-

3rd. That the term of a patent should be 21 years—now fourteen—without provision for extention.

4th. That the official fees should be reduced from £175 to £10 for the entire term, which is sufficient to defray the expenses of an efficient patent system

5th. That the French mode of granting patents—without official investigation of the merits of the application—should be adopted.

6th. That in patent suits the rights of patentees should be determined by a competent court of equity, dispensing with *jurors* and "*expert*" witnesses.

VALUE OF AMERICAN PATENTS IN EUROPE.—The American origin of an invention, says the *Anglo-American Times*, is now a recommendation in Europe, where many of these inventions are in successful operation, and large fortunes have been realized by their introduction. Improvements relating to some manufactures are of great value in this kingdom. Mr. Bessemer derives an annual income of about $2,000,000 from his British steel patents, and the patentee of a device for dressing millstones by a revolving diamond, has realized over $1,000,000 the first year of his patent. The use of a diamond for this purpose is an American invention, and the estimated value of the exclusive right in England, for ten years, is $5,000,000. British patents, as a rule, are the most valuable, but many inventions are equally profitable in other parts of Europe, and some are peculiarly adapted to Continental wants and customs.

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LEONARD D. GALE, Consulting Chemist.

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GALE and Rand Patents,

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We are also prepared to contract for putting said process into successful operation in your works, furnishing all the necessary plans, materials, and workmen for that purpose.

We do not deem it necessary to enter upon a detailed description, here, of the processes above referred to, deeming it sufficient to state, to secure your interest and investigation, that they have been in successful operation, for months, in a number of Gas-Light Works in the United States, and are now being introduced in the works of the Mutual Gas-Light Company, of New York City; the Citizens' Gas-Light Company, of Brooklyn; the New Orleans, San Francisco, and very many other Gas-Light Companies throughout the country.

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Which are the best and cheapest?

We refer to over sixty companies *now* using them.

BROOKLINE, June 17, 1871.

E. DUFFEE, ESQ.:

Dear Sir: You will please make a set of Gas Trays for this Company as soon as convenient, at price named.

In regard to the merits of the Tray, after having them in constant use for over two years, I will say that I consider them *superior to any Tray* manufactured in this country.

Respectfully Yours,
H. A. ALLYN,
Superintendent Brookline Gas-Light Co.

EAST BOSTON, June 15, 1871.

Gentlemen: We have used your Screens some five years they give perfect satisfaction.

I consider them *by far the best Screen* for Dry Lime Purifiers I have seen.

Yours truly,
A. M. NORTON,
Supt. East Boston Gas-Light Co.

CHELSEA, May 1, 1871.

MR. E. DUFFEE:

We are using your Purifying Trays, and find them to be the *best of any* that I have used, and will *purify more gas with less pressure* than any tray that I know. I can fully recommend them, after four years trial, to any Gas Superintendent with perfect safety, as the *cheapest and best Tray made.*

Yours truly,
JOHN ANDREW, Supt.

JAMAICA PLAINS, MASS., June 21, 1871.

EDWARD DUFFEE, ESQ:

Dear Sir: The Trays ordered by this Company three years ago, are getting somewhat worn. I wish to say here that I consider your Trays to be superior to any yet invented, therefore please make us another set at the price named, to be like the sample shown in every way, and oblige. Yours truly,
JAMES F. ROGERS,
Supt. Jamaica Plains Gas-Light Co.

Also see letter from Providence, R. I., in another column.

It will be for the interest of all Gas-Light Companies needing new Trays another season, to give their orders early, to be delivered where wanted, as we were unable to fill orders promptly to Companies ordering late last fall.

American Gas Screen Man'f'g Company.
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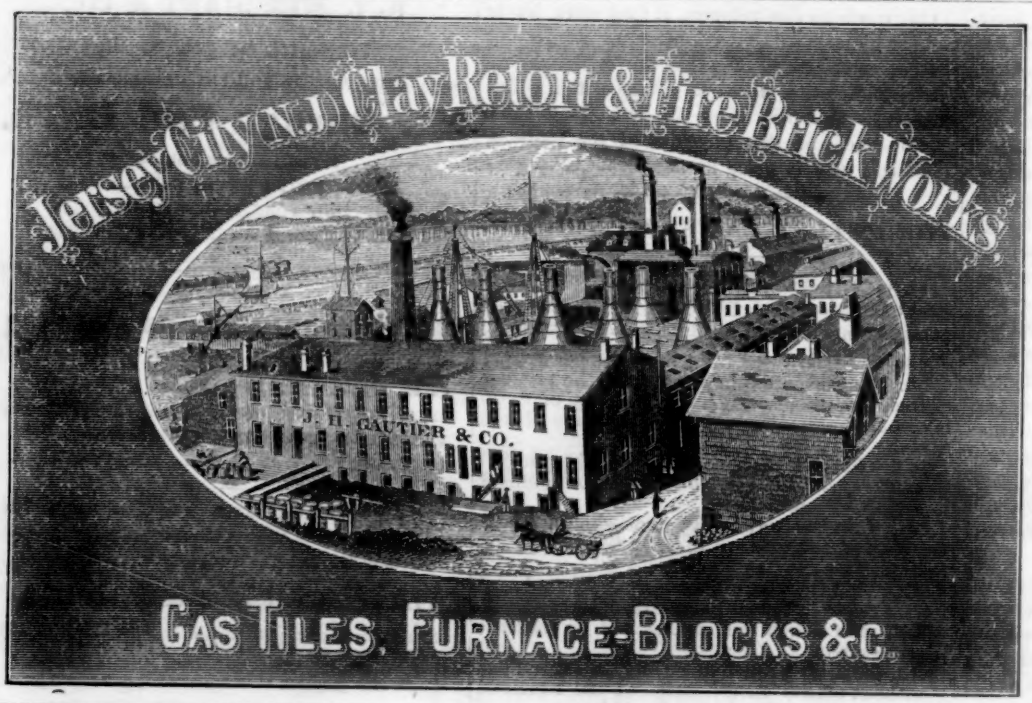

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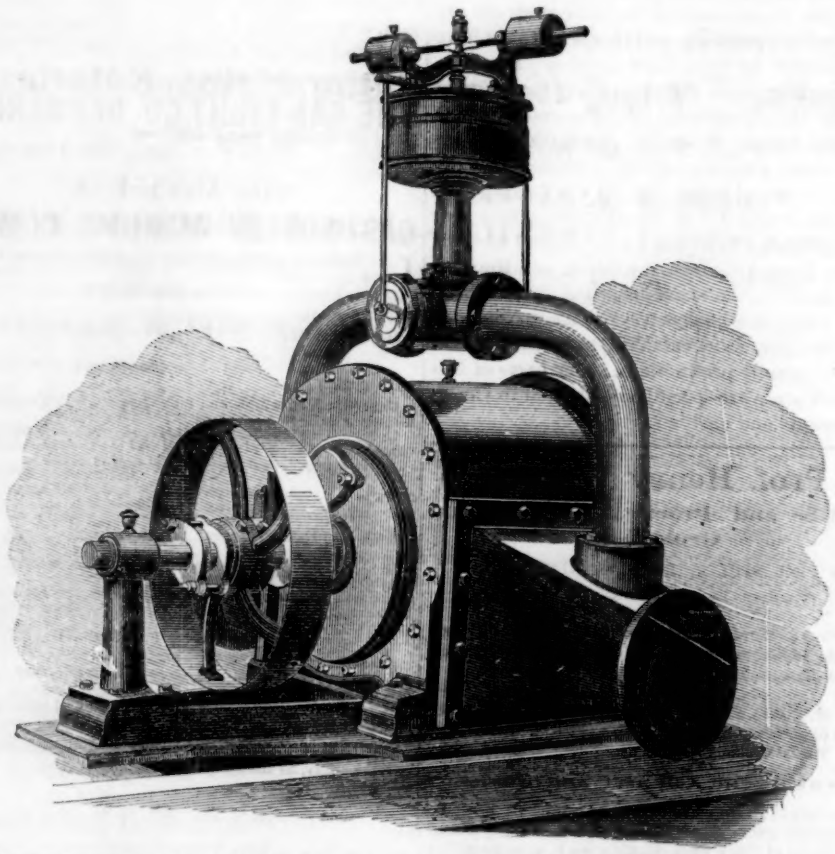

They are made to pass from 4,000 to 150,000 cubic feet of gas per hour; will increase the production and illuminating of the gas, and add very much to the durability of the retorts, either clay or iron. The Compensator obviates entirely necessity of water-joints, is compact, durable, cleanly, not liable to get out of order, self-acting, quiet, and certain in its lation.

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J. W. GRAHAM,

Dear Sir: Yours of the 14th inst at hand. In reply I would say that we have tested the six anti-freezing Lamp Posts purchased from you, and find them to be all as you represented. Whilst nearly a dozen of our sixty-five Posts were frozen down last month and first of this not one of yours was affected by the heavy frost. What can you sell them at?

Yours truly,
LUCAS FLATTERY,
Sec'y Wooster Gas-Light Co.

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J. W. GRAHAM,
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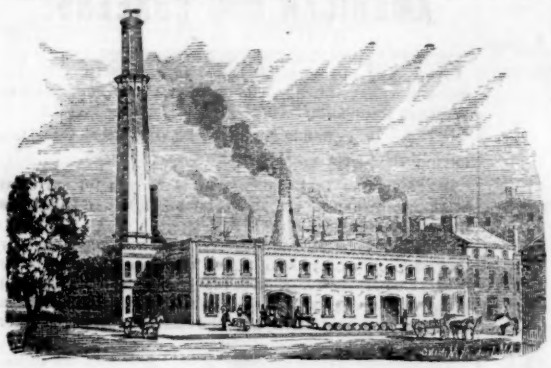

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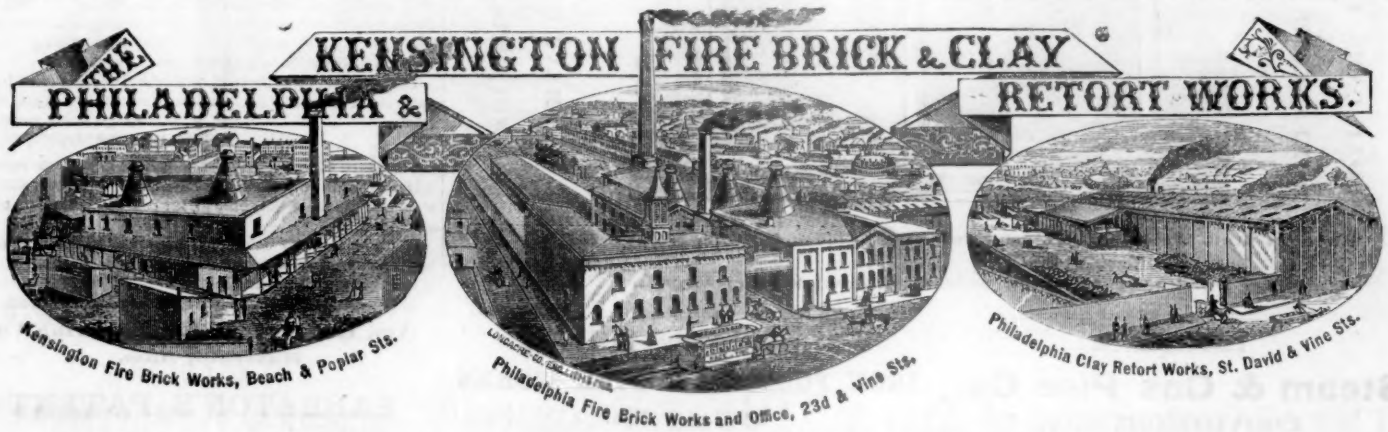
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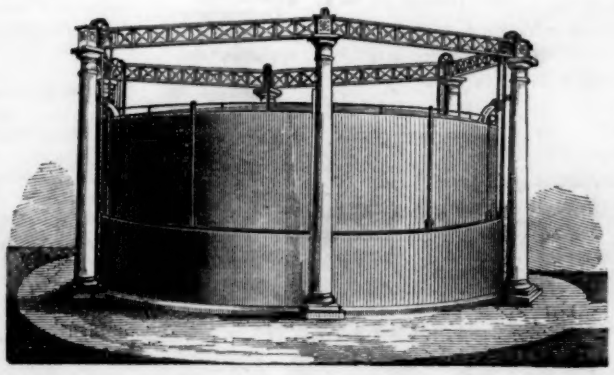

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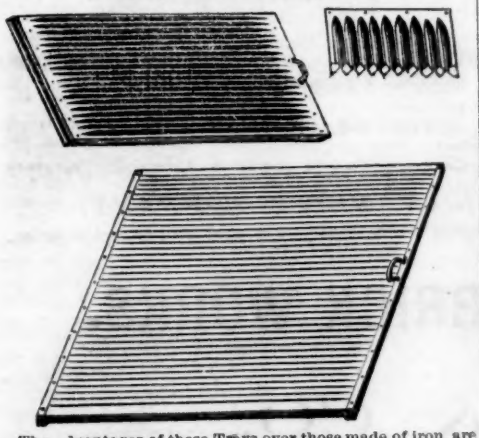

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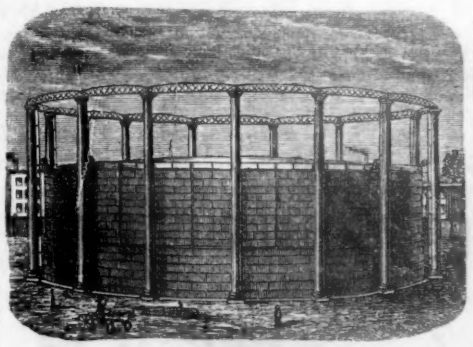

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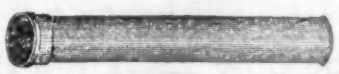

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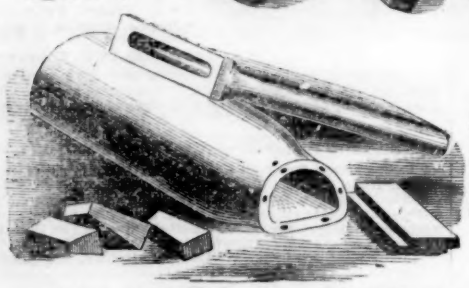

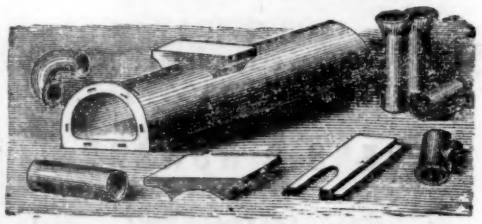

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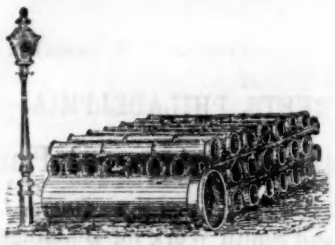

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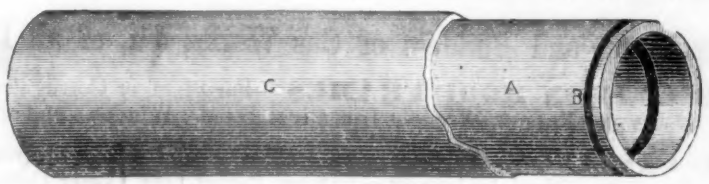

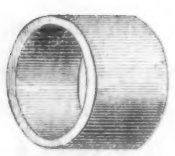

FIG. 2.

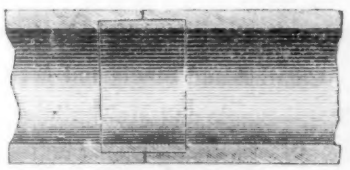

FIG. 3.

A—Cylinder of Wood. B—Band of Iron. C—Coating of Hydraulic or Asphaltum Cement.

FIG. 2.—Thimble for Connection. FIG. 3.—Horizontal Section and Connection.

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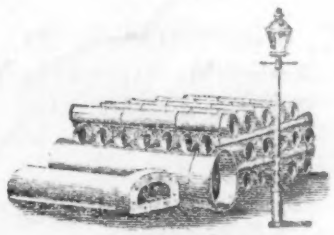

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